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[54] **DEVICE UTILIZING A ROTARY DISC HAVING A GRIPPING ELEMENT FOR RAPIDLY FEEDING SHEET INSERTS TO A PUSHER CONVEYOR OF A PACKAGING MACHINE**

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[51] **Int. Cl.**^{6} **B65H 5/22**

[52] **U.S. Cl.** **271/3.23**; 271/12; 271/225; 271/245; 271/184; 271/196; 270/58.29

[58] **Field of Search** 271/3.18, 3.21, 271/3.23, 4.12, 11–13, 5, 184, 196, 231, 245, 250, 251, 271; 270/58.29, 58.24, 58.16

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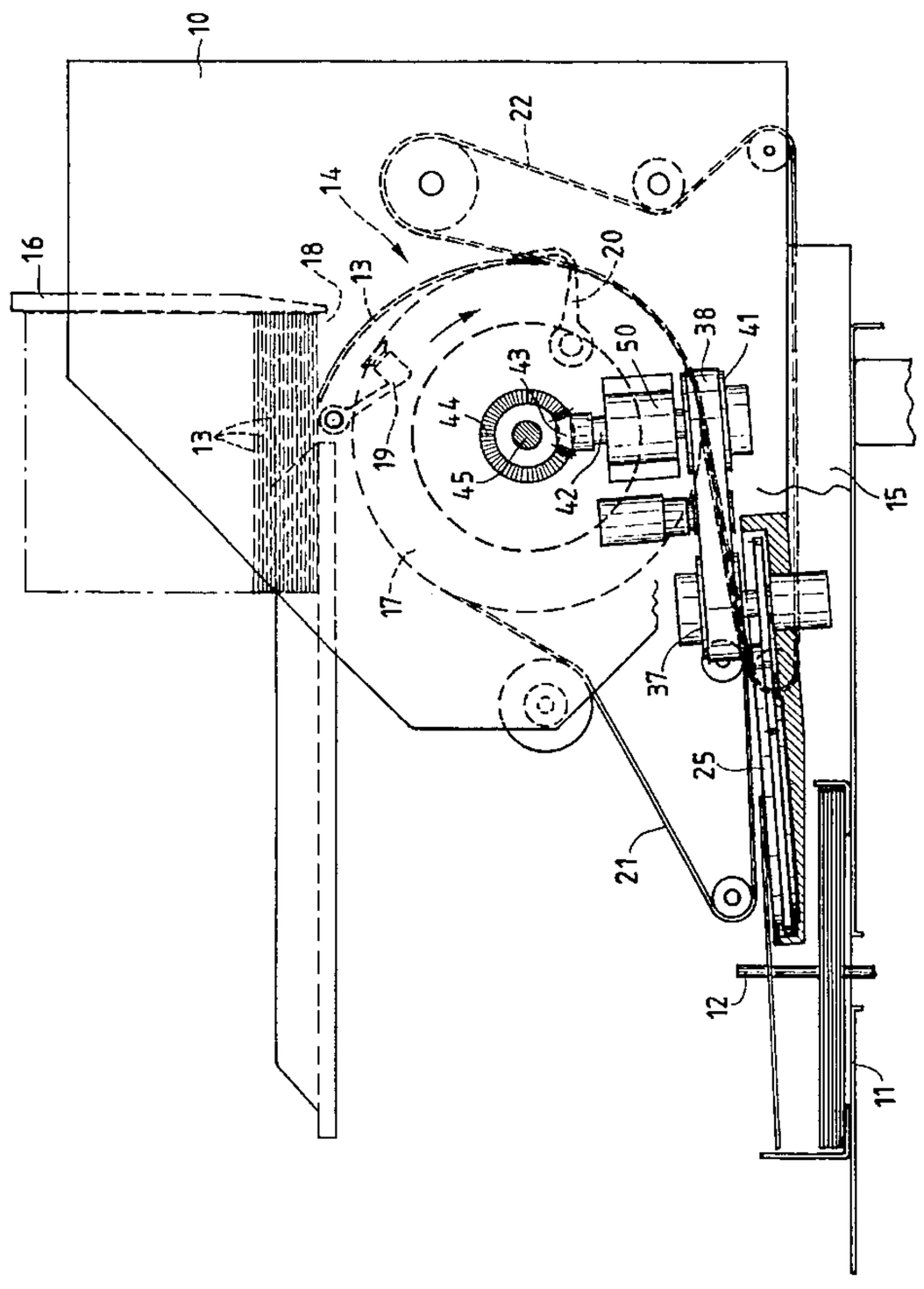
[57] **ABSTRACT**

A device for rapidly feeding sheet inserts to a pusher conveyor of a packaging machine having upstream of the device a feeder for feeding sheet inserts one after another in a direction essentially perpendicular to the pusher conveyor, including at least one rotary disc provided with at least one element for gripping the sheet insert, the at least one gripping element being operable selectively to lock the sheet insert onto the disc and drag the sheet insert from a position aligned with the insert feeder to an advanced position on the pusher conveyor by causing the sheet insert to undergo a rototranslational movement, the relative drive mechanism for the disc, for the sheet insert feeder and for the pusher conveyor being correlated in their movement.

26 Claims, 4 Drawing Sheets



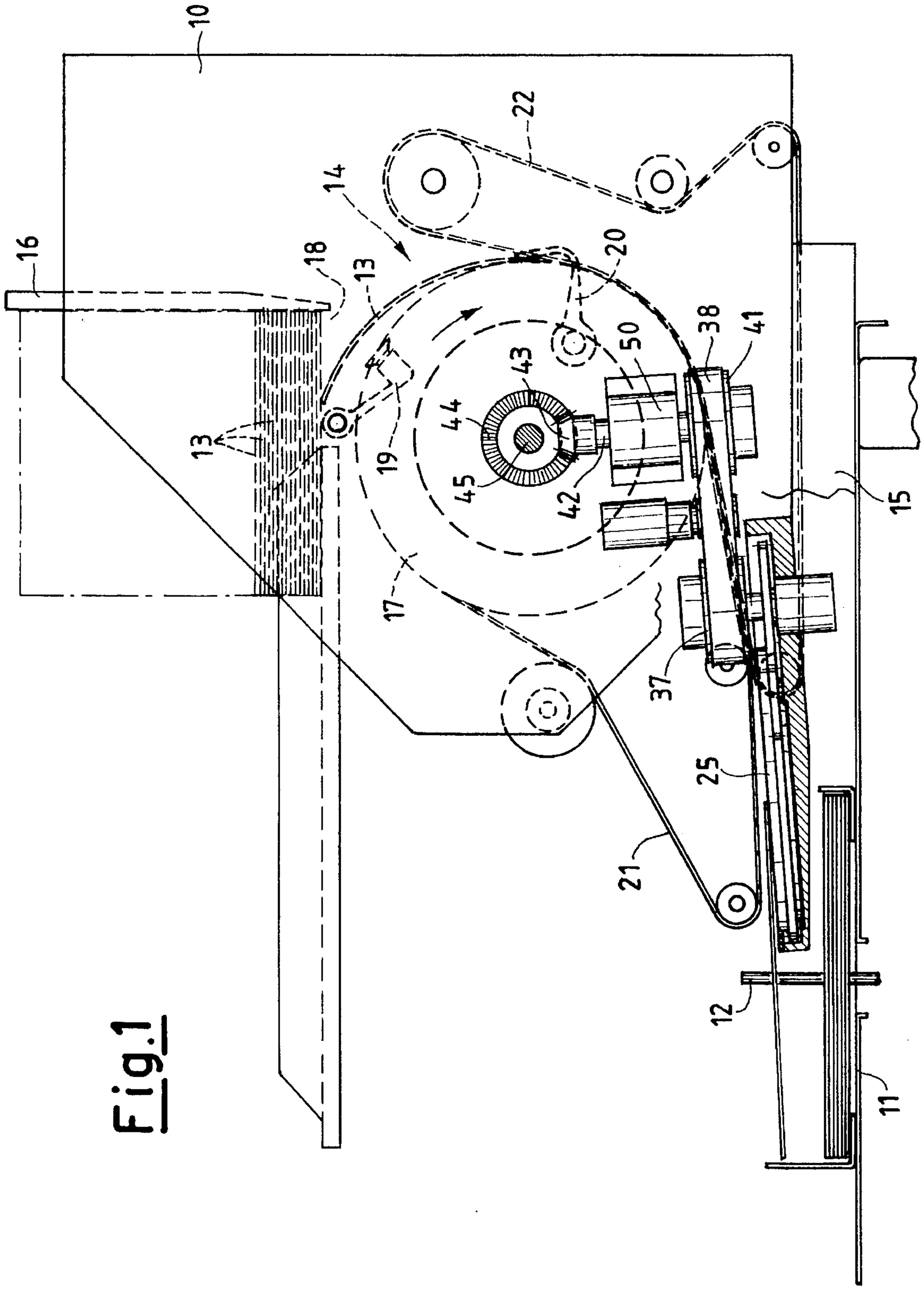


Fig.1

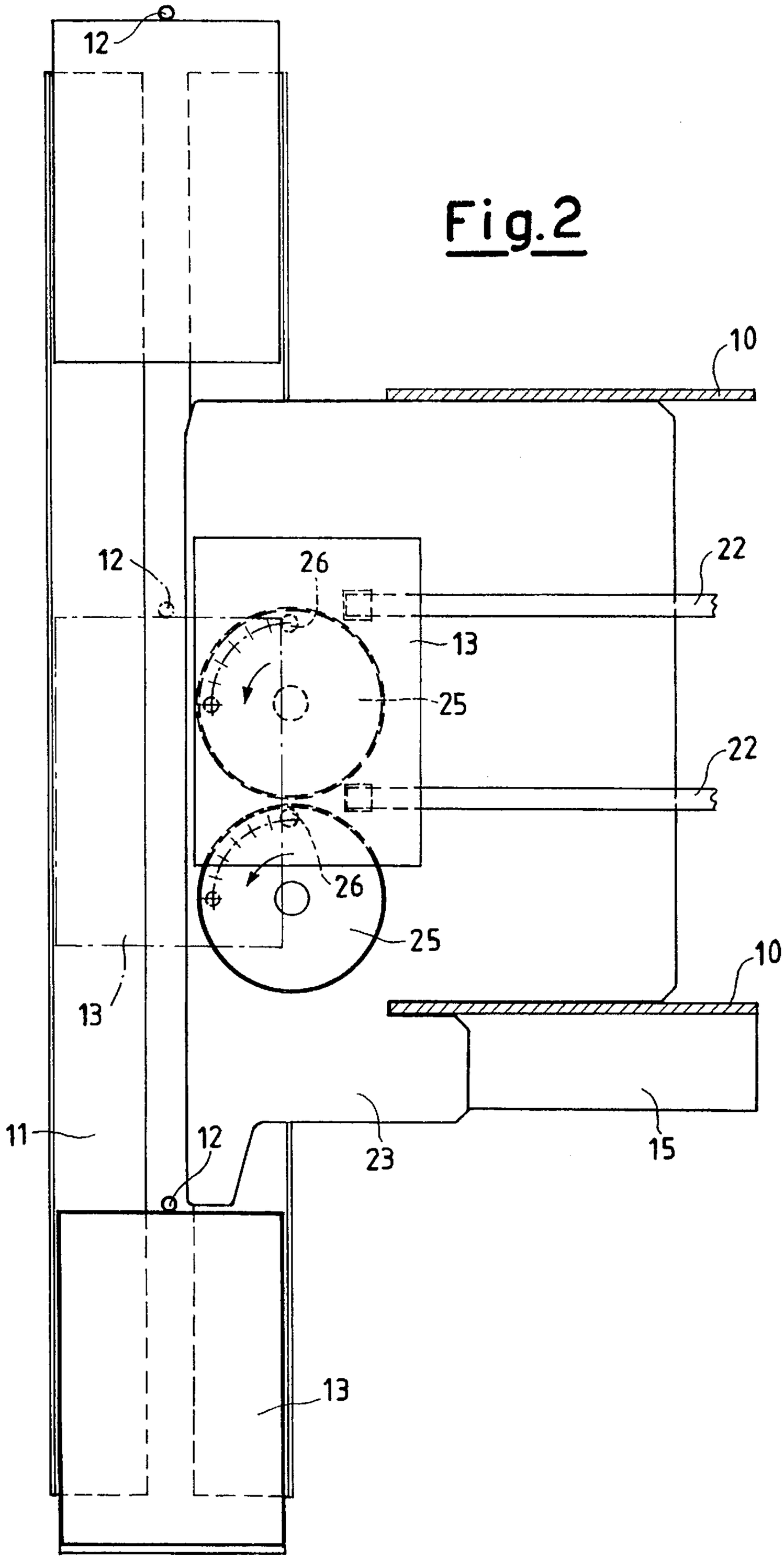


Fig.2

Fig.3

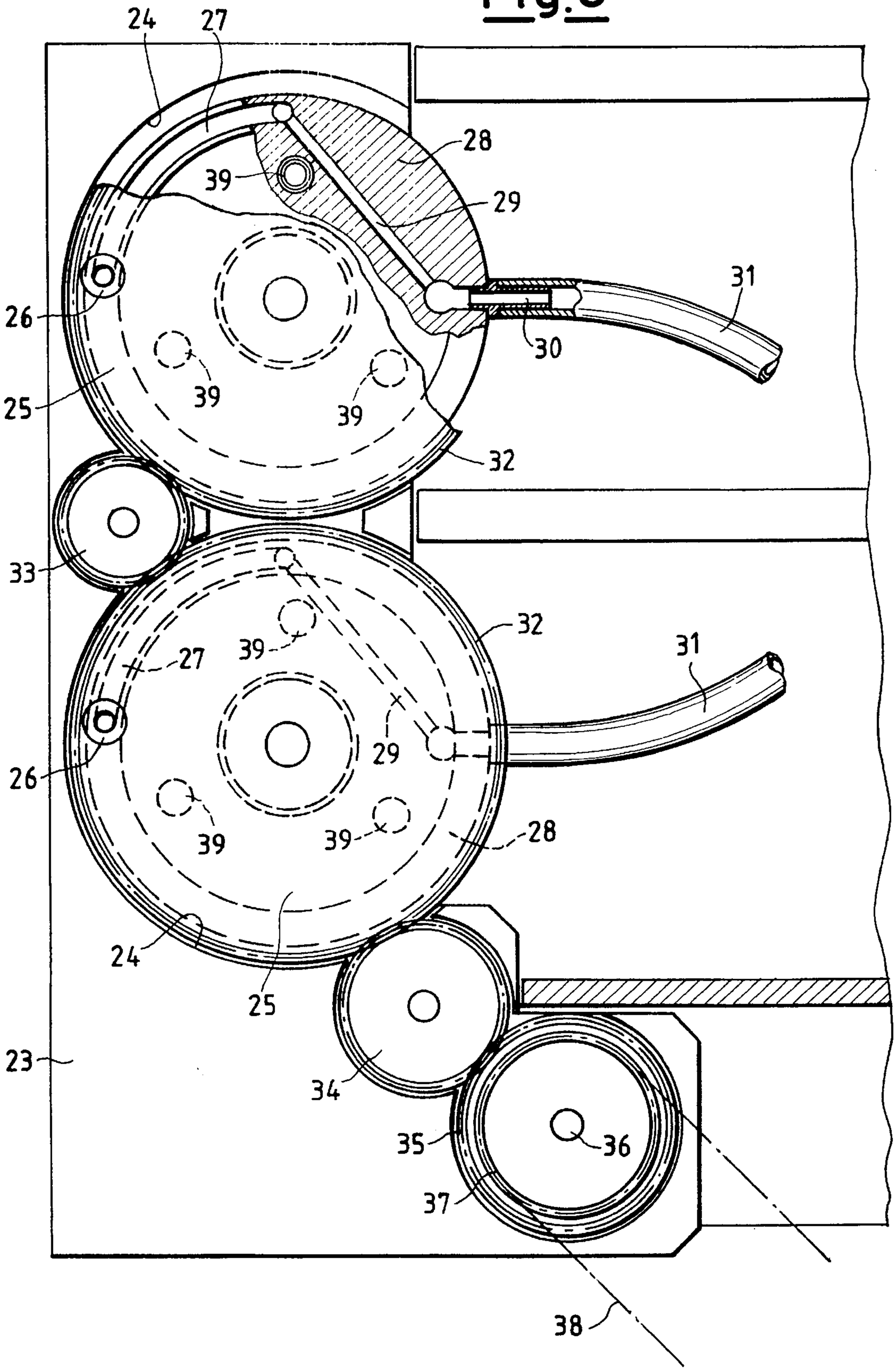

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Fig.4

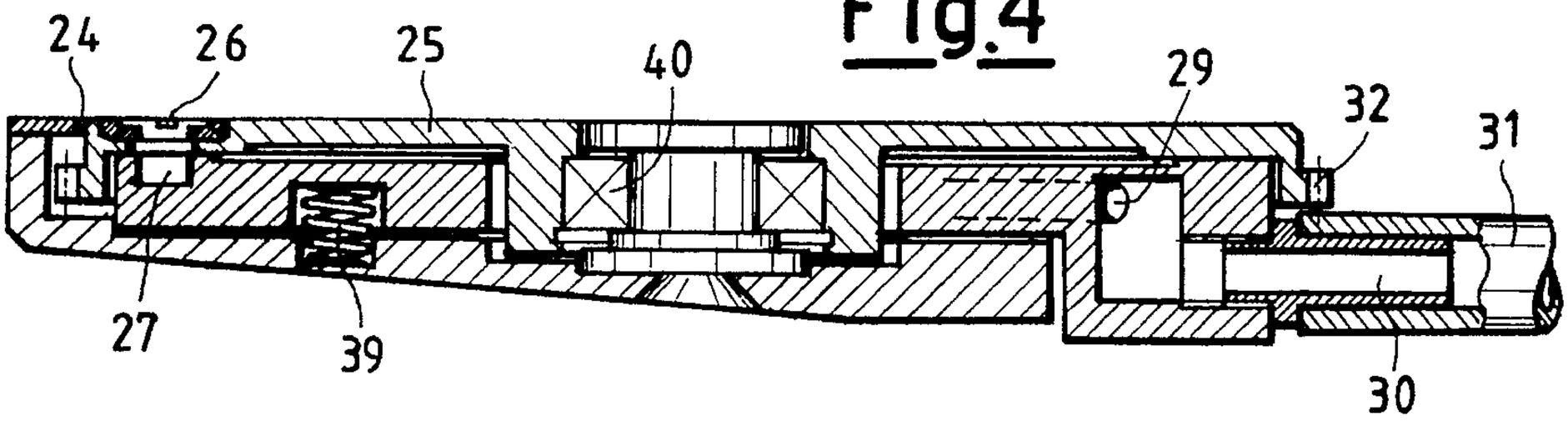
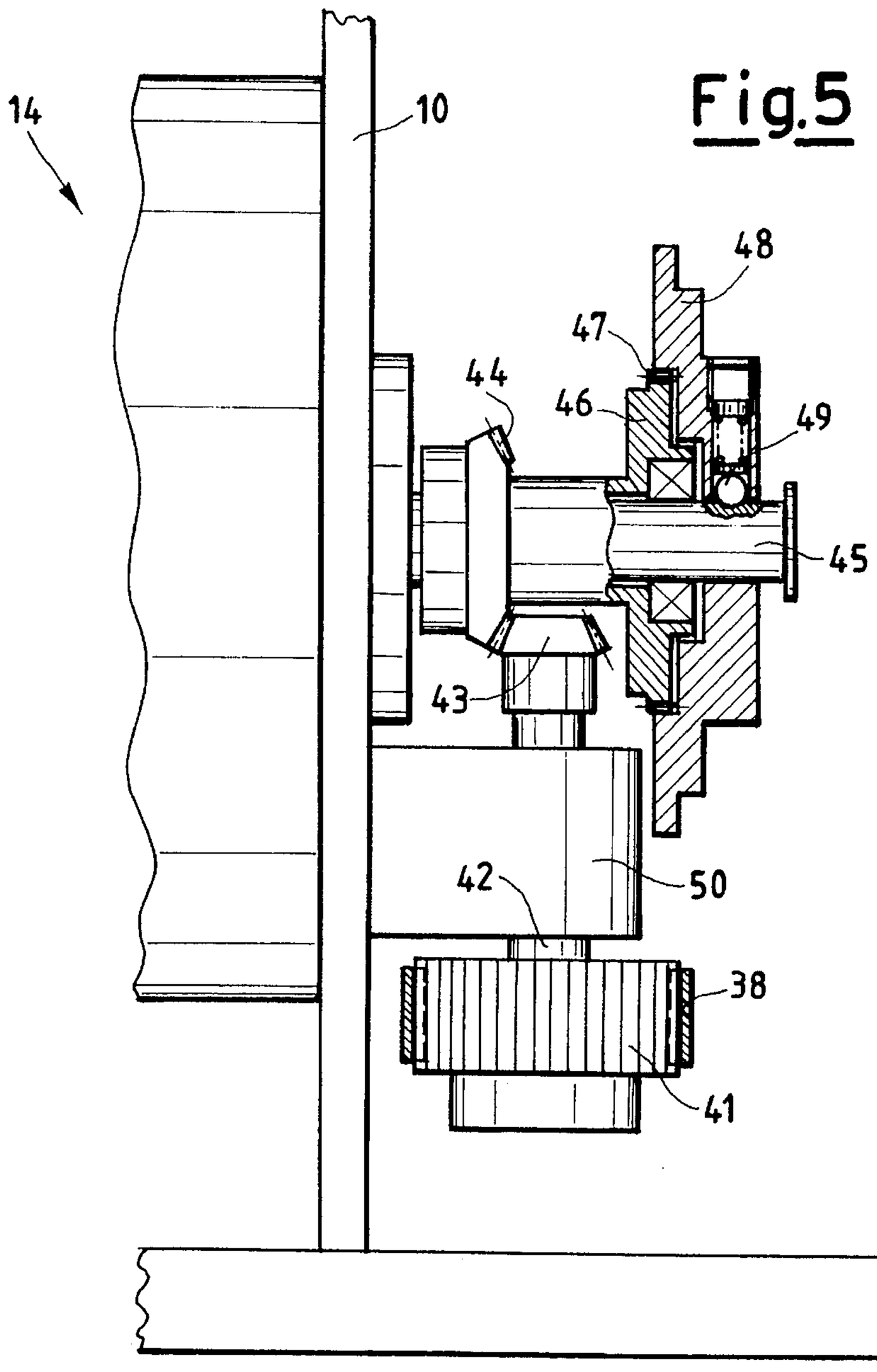


Fig.5



DEVICE UTILIZING A ROTARY DISC HAVING A GRIPPING ELEMENT FOR RAPIDLY FEEDING SHEET INSERTS TO A PUSHER CONVEYOR OF A PACKAGING MACHINE

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to a device for rapidly feeding sheet inserts to a pusher conveyor of a packaging machine.

In machines for packaging flat products of a graphic or editorial type, such as sheets, signatures, magazines, brochures etc., these products, known hereinafter for convenience as "sheet inserts", have to be fed, for example, individually onto a conveyor. The conveyor conveys them to a unit for their packaging within a plastics film or a suitable paper sheet. Such inserts mostly require to be fed in a certain additional number to a base product, a high operating rate being essential.

Up to the present time so-called drum feeders have been used positioned to the side of the pusher conveyor of the collection line, to feed the individual inserts onto the editorial base product. By using a certain number of drum feeders for single inserts or sheet elements positioned one after another, the required product containing a number of such inserts is gradually formed. Such an arrangement has certain technical drawbacks.

In this respect, the fact of laterally positioning drum feeders or other types of feeders means that the single insert or similar fed product reaches the collection conveyor in a perpendicular direction at 90° to the direction of movement of the pushers which advance with the conveyor. In such a case there is a sudden directional change of the fed product, resulting in a reduction in production rate proportional to the type of product collected by the conveyor. This reduction is due both to problems of possible product damage and to problems of correct feed to each individual pusher, because, for example, the product has to be added to and superposed on another which has already been moved forward by the advancing pushers.

If the inserts are light in weight or are of little rigidity, this problem becomes even more serious because of the danger of damage and the poor stability of the insert if fed to the conveyor at high speed.

In general, feeding the various inserts at 90°, whether they are to be added to others or not, requires a pitch between one pusher and the next which is sufficiently large to prevent interference arising on lateral insertion which would prevent the sheet inserts assuming their correct position. This also influences the maximum advancement speed, resulting in a potential production loss and an increase in production costs.

SUMMARY OF THE INVENTION

An object of the present invention is to achieve the fastest possible feed of sheet inserts to a pusher conveyor of a packaging machine.

A further object is to correctly achieve this feed both for rigid, heavy inserts or the like, and for lightweight or flexible inserts.

These objects are attained according to the present invention by a device for rapidly feeding sheet inserts to a pusher conveyor of a packaging machine comprising upstream of said device a feeder for feeding sheet inserts one after another in a direction essentially perpendicular to said pusher conveyor, characterised by comprising at least one rotary disc provided with at least one element for gripping said sheet insert, said at least one gripping element being operable selectively to lock said sheet insert onto said disc and drag said sheet insert from a position aligned with said insert feeder to an advanced position on said pusher conveyor by causing the sheet insert to undergo a rototranslational movement, the relative drive means for said disc, for said sheet insert feeder and for said pusher conveyor being correlated in their movement.

BRIEF DESCRIPTION OF THE DRAWINGS

The characteristics and advantages of a device for rapidly feeding sheet inserts to a pusher conveyor of a packaging machine according to the present invention will be more apparent from the following description given by way of a non-limiting embodiment with reference to the accompanying schematic drawings, in which:

FIG. **1** is a partly sectional schematic side view of a drum feeder provided with a device according to the present invention and associated with a pusher conveyor;

FIG. **2** is a plan view from above of the device and conveyor, and showing a belt which collaborates with the drum feeder;

FIG. **3** is a partly sectional enlarged plan view from above of a detail of FIG. **2**, in which the device of the present invention can be seen;

FIG. **4** is a cross-section through a disc shown in FIG. **3**;

FIG. **5** is a partly sectional enlarged view of the disc drive region, which comprises a disc phasing unit.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. **1** and **2** show part of a packaging apparatus comprising a conveyor which comprises a channel **11** within which a plurality of pushers slide so as to form a pusher conveyor **12**, for example, driven by an underlying chain not shown. The channel **11** receives a series of sheet inserts **13**, for example from a plurality of lateral drum feeders **14**, of which only one is shown, and this only partially.

Between the pusher conveyor **12** and the drum feeder **14** there is provided a device for rapidly feeding sheet inserts **13** formed in accordance with the invention.

A device according to the invention is positioned within the main frame **15** of the conveyor **11**, **12** or packaging apparatus, to the side of the conveyor channel **11** along which the graphic and/or editorial products advance. In the illustrated example this rapid feed device is located below the drum feeder **14**. The drum feeder **14** is bounded by two walls **10** and comprises, for stacked inserts **13**, a container **16** positioned above one or more drums **17** for withdrawing the individual inserts **13** and transporting them towards the conveyor.

At a base aperture **18** in the container **16** there is positioned at least one withdrawal element in the form of suckers **19** which engage the lower surface of the insert **13** and, by rotating, withdraw it from the container and place it against the rotating outer surface of the one or more drums **17**. These carry gripping elements **20** of a gripper type, which receive the insert from the suckers **19** and retain it on the drum during rotation.

The insert **13** is then received between pairs of upper guide belts **21** and lower guide belts **22**, which are mutually superposed to contain the inserts **13**. The guide belts **21** and **22** rotate together with the drums **17**, and drag the inserts towards a device according to the invention.

The device for rapidly feeding the inserts **13**, located within the frame **15**, comprises a base plate **23** positioned nearly at the base of the two walls **10** and provided, in the illustrated example, with two seats **24** for accommodating a pair of discs **25**. The two discs **25** rotate and are provided with a sucker **26** housed in the upwardly facing surface of the disc and connectable to a vacuum source. In the seat **24** in the base plate **23** there is located a fixed backing disc **28**, for example of an antifriction and/or self-lubricating material, which is maintained in contact with the rotary disc **25** by elastic elements **39**. In that surface facing the respective disc **25**, the backing disc **28** is provided with a recess **27** extending through a certain arc, for example up to 90°. The recess **27** is connected at one end to an internal channel **29** which extends as far as a fixed connector **30** for connection to a tube **31** from the vacuum source.

Each disc **25**, rotatably supported on central bearings **40**, comprises, in a region below the surface of the base plate **23**, peripheral toothing **32** its rotation. For this purpose two idle gearwheels **33** and **34** are located in the base plate **23**, the first gearwheel **33** being interposed between the toothings **32** of the two discs so as to cause them to rotate in the same direction. The second idle gearwheel **34** engages the toothing **32** of one of the discs **25** and is rotated by a further gearwheel **35**. The gearwheel **35** is located on a shaft **36** carrying coaxially a toothed pulley **37** rotated by a toothed belt **38** arranged mechanically to rotate in synchronism with the possible drum feeders **14**, guide belts **21** and **22** or similar units which feed the inserts one after another in a direction perpendicular to the pusher conveyor.

The suckers **26** are snap-fitted into their seats and are free to rotate so as not to create problems of damage to the insert on which they engage. To achieve a better grip the suckers **26**, of plastics construction, can for example comprise cross-recessed suction surfaces.

Consequently the insert **13** which, contained between the two guide belts **21** and **22**, arrives on the base plate **23** is engaged by the two suckers **26** of the two discs **25** in the position shown by full lines in FIG. **2**. As the discs **25** are rotated by the relative gearwheels as stated, the insert **13**, now positioned and locked, is moved with rototranslational movement into its final position, shown by dashed and dotted lines in FIG. **2**. In this manner, besides being directed into the channel **11**, the insert **13** is made to advance in the same advancement direction as the conveyor pushers **12**.

When the insert **13** reaches its aligned position within the channel **11**, the suckers **26** disengage the insert or sheet element **13**. In this respect the suckers **26**, rotating with the discs **25**, firstly reach the initial end of the recess **27**, ie the initial position indicated by full lines in FIG. **2**. They then lie over the initial end of the recess **27**, to become connected to vacuum and suck the insert to lock it on the disc. As rotation continues, after about 90° the suckers **26** reach the final end of the recess **27** and are consequently disconnected from the vacuum source, so releasing the insert **13**.

Alternatively, the suckers **26** could be located fixed relative to the disc **25**. In this case a single disc can be used and the insert be rotated through 90°, such positioning for example being required relative to the pusher conveyor. With a single disc and a single sucker it is hence also possible to maintain the arrival position of the insert **13** for example by providing a cam mechanism which, on rotating the disc through 90°, rotates the sucker in the same direction to maintain the direction of the insert.

A device according to the present invention hence enables the time involved in moving the insert to be also used for advancing it in the direction of advancement of the collection conveyor. Besides enabling the entire apparatus to operate at an increased rate, this particular arrangement enables the individual pushers **12** to be positioned one after another at a smaller distance apart than in known conveyors used up to the present time.

FIG. **5** is an enlarged partly sectional view of the disc drive region which also advantageously comprises a phasing unit for the discs. In this manner the positions of the suckers relative to the inserts being fed can be coordinated to further improve the feed.

In this respect, the toothed belt **38** is rotated by a toothed pulley **41** positioned on a shaft **42** contained within a support **50** rigid with a wall **10** of the drum feeder or with the frame **15**. Rigid with the shaft **42** there is a bevel gear **43** driven by a second bevel gear **44** rotating on a shaft **45**. An extension or bush **46** fixed to the second bevel gear **44** also supports a further gear **47** engagable with a gear **48** comprising complementary internal toothing. This latter can be made to securely engage the shaft **45** by a locking pin arrangement indicated schematically by **49**. By disengaging the locking pin **49** from the shaft **45** the internal gear **48** can be withdrawn from the gear **47** to enable it to rotate freely. This also determines the rotation of the bevel gear pair **44**, **43**, the shaft **42**, the toothed belt **38**, the various gearwheels **35**, **34**, **33** and consequently the discs **25** by means of their toothings **32**. Having achieved the angular phasing of the discs **25** and consequently of the relative suckers **26**, to the extent necessary to delay or to anticipate the sucker suction on the insert **13**, the internal gear **48** is re-engaged with the complementary externally toothed gear **47**. The locking pin **49** is then re-engaged with the drive shaft **45** to consequently achieve mechanically synchronized movement of the various elements.

As already stated, the transfer of the insert or a similar sheet element from the drum feeders or from any other feeder, for example consisting simply of pairs of superposed belts, hence occurs without any stressing and moreover with the same direction of advancement as the collection conveyor. This continuous transfer motion achieved by the collaboration between the discs and the suckers means that light, flexible, delicate or other such products can be fed to the conveyor, which can advantageously have a smaller pitch between one pusher and the next.

All these arrangements of the present invention result in an increased production rate with consequent lowering of packaging costs, while always achieving correct packaging.

It must be emphasized that a device according to the present invention can be advantageously used for rapidly feeding the sheet inserts **13** comprising graphic and/or editorial products, such as single sheets, signatures, magazines, brochures and the like, sewn or not sewn, in any prechosen number.

We claim:

1. A device for rapidly feeding sheet inserts to a pusher conveyor of a packaging machine, which comprises:

a feeder feeding sheet inserts one after another in a direction substantially perpendicular to said pusher conveyor;

a pair of rotary discs each of which is provided with a substantially flat surface which is substantially parallel

to the inserts and each includes at least one suction element gripping said sheet inserts by suction, said at least one gripping element being selectively operable to lock said sheet inserts onto each of said discs and drag said sheet inserts by suction from a position aligned with said insert feeder to an advanced position on said pusher conveyor by causing the sheet inserts to undergo a rototranslational movement due to synchronized movement of said discs, and

drive means for each of said discs, for said sheet insert feeder and for said pusher conveyor wherein movement of said discs, said sheet insert feeder and said pusher conveyor are synchronized.

2. A device as claimed in claim **1**, wherein each said at least one gripping element comprises a sucker located on a respective one of said discs.

3. A device as claimed in claim **2**, wherein each said sucker is selectively connectable to a vacuum source.

4. A device as claimed in claim **3**, which comprises a base plate wherein each said disc is positioned in a seat provided in said base plate and said base plate is located at an exit portion of said sheet insert feeder.

5. A device as claimed in claim **4**, wherein said rotary discs are each arranged on a fixed backing disc of an anti-friction material, which is maintained in contact with a respective one of said rotary discs by elastic elements arranged between a respective one of said seats and said backing disc.

6. A device as claimed in claim **5**, wherein a surface of each said backing disc is provided with a recess which extends through an arc and is connected at one end to an internal channel which extends to a fixed connector receiving a tube from the vacuum source, said recess being brought into connection with said sucker during rotation of each said rotary disc.

7. A device as claimed in claim **6**, wherein each said recess provided in a respective one of said backing discs extends through an arc of up to 90°.

8. A device as claimed in claim **1**, wherein movement of each said rotary disc is phased with respect to said sheet insert feeder by means of a freely releasable and adjustable toothed coupling provided with means for locking the toothed coupling to a central drive shaft.

9. A device as claimed in claim **2**, wherein each said sucker is respectively rotatable relative to said respective one said disc.

10. A device as claimed in claim **1**, wherein said gripping elements of said discs are separate from each other and said discs are caused to rotate simultaneously in the same direction by an interposed mechanical transmission.

11. A device as claimed in claim **1**, wherein said sheet insert feeder comprises a drum feeder.

12. A device as claimed in claim **1**, wherein said sheet insert feeder comprises at least one pair of superposed belts containing said sheet inserts therebetween.

13. A device as claimed in claim **1**, wherein said sheet inserts comprise one of graphic and editorial products.

14. A device for rapidly feeding sheet inserts to a pusher conveyor of a package machine, which comprises:

a feeder feeding sheet inserts one after another in a direction substantially perpendicular to said pusher conveyor;

a pair of rotary disks each of which is provided with a substantially flat surface which is substantially parallel to the inserts and each includes at least one suction element gripping said sheet inserts by suction, said at least one gripping element being selectively operable to lock said sheet inserts onto each of said disks and drag said sheet inserts from a position aligned with said insert feeder to an advanced position on said pusher conveyor by causing the sheet inserts to undergo a rototranslational movement due to synchronized movement of said disks, and

a drive mechanism driving each of said disks, said sheet insert feeder and said pusher conveyor, wherein movement of said disks, said sheet insert feeder and said pusher conveyor are synchronized.

15. A device as claimed in claim **14**, wherein each said at least one gripping element comprises a sucker located on a respective one of said discs.

16. A device as claimed in claim **15**, wherein each said sucker is selectively connectable to a vacuum source.

17. A device as claimed in claim **16**, which comprises a base plate wherein each said disk is positioned in a seat provided in said base plate and said base plate is located at an exit portion of said sheet insert feeder.

18. A device as claimed in claim **17**, wherein said rotary disks are each arranged on a fixed backing disk of an anti-friction material, which is maintained in contact with a respective one of said rotary disks by elastic elements arranged between a respective one of said seats and said backing disk.

19. A device as claimed in claim **18**, wherein a surface of each said backing disk is provided with a recess which extends through an arc and is connected at one end to an internal channel which extends to a fixed connector receiving a tube from the vacuum source, said recess being brought into connection with said sucker during rotation of each said rotary disk.

20. A device as claimed in claim **19**, wherein each said recess provided in a respective one of said backing disks extends through an arc of up to 90°.

21. A device as claimed in claim **14**, wherein movement of each said rotary disk is phased with respect to said sheet insert feeder via a freely releasable and adjustable toothed coupling provided with a lock mechanism locking the tooth coupling to a central drive shaft.

22. A device as claimed in claim **15**, wherein each said sucker is respectively rotatable relative to said respective one said disk.

23. A device as claimed in claim **14**, wherein said gripping elements of said disks are separate from each other and said disks are caused to rotate simultaneously in the same direction by an interposed mechanical transmission.

24. A device as claimed in claim **14**, wherein said sheet insert feeder comprises a drum feeder.

25. A device as claimed in claim **14**, wherein said sheet insert feeder comprises at least one pair of superposed belts containing said sheet inserts therebetween.

26. A device as claimed in claim **14**, wherein said sheet inserts comprise one of graphic and editorial products.

* * * * *